V13D-0420: The Pleistocene Panamanian adakitic rocks: a slab melt or an evolved mantle-derived magma?

Monday, 11 December 2017
13:40 - 18:00
New Orleans Ernest N. Morial Convention Center - Poster Hall D-F

Adakite was originally thought to be formed by slab melting, however it has been suggested that adakitic magmas can also be generated by melting of under-plated arc basalts at high pressure or by differentiation of mantle-derived basaltic arc magma where the arc crust is thick enough for garnet ± amphibole fractionation (≥30km) in subduction zones. The Pleistocene volcanic rocks in Panama, Central America are characterized by adakite-like geochemical features of high Sr/Y and La/Yb with low Y and Yb contents. Previous studies on Nd, Sr and Pb isotopes suggested that their mantle source has moderate amounts of the Galapagos hotspot tracks component. We have investigated trace elements and Nd, Sr and Pb isotope geochemistry and mineralogy of six Panamanian volcanic rocks in order to better understand their petrogenesis. Our results confirm that they are characterized by enrichments in LILE with high LREE abundances and pronounced depletions in the HREE and HFSE, suggesting large influence of enriched slab components. The isotope data are consistent with those of arc basalts that erupted >2 Ma prior to the Panamanian adakitic rocks in the same region, which originated from the mantle metasomatized by melts from the Cocos ridge. The compositions of amphibole phenocrysts from the adakitic rocks suggest that the magma stalled at the depth of ~15km and ~35km respectively. Calculated melt compositions in equilibrium with the high-pressure amphibole (~35km) using mineral-melt partition coefficients are of adakite. We performed trace element and isotope modeling to examine the three hypotheses for the formation of adakitic rocks in subduction zones: i) direct melting of subducting slab, ii) re-melting of under-plated arc basalts, iii) fractionation of mantle-derived basaltic magma at high pressure. The results show that the compositional variations of the Panamanian adakitic rocks are best explained by fractional crystallization of basaltic arc melts, whose mantle source was metasomatized by slab melts from the Cocos ridge, at crustal depth where garnet and amphibole are stable. This is consistent with the presence of high-pressure amphibole phenocrysts, depleted HREE contents in the Panamanian volcanic rocks (Sm/Yb ~>4).

Plain Language Summary

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